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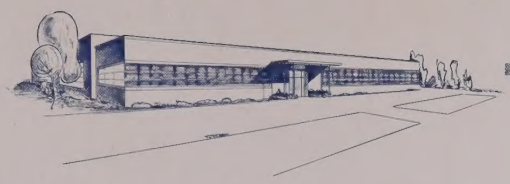

INSTRUCTION MANUAL

Model 5581/4
CONVERTER UNIT

SER # 246

INDUSTRIAL AND NUCLEAR INSTRUMENTS

ANALOG COMPUTERS

PROPERTY OF ENGINEERING
TEST EQUIPMENT
CROSLEY, DIV. OF AVCO
ITEM 9 COPY 3

Berkeley division
BECKMAN INSTRUMENTS, INC.
2200 WRIGHT AVE., RICHMOND, CALIF.
TELEPHONE: LANDSCAPE 6-7730

GROUND COMMUNICATIONS SECTION

WARNING

Do not attempt to operate this instrument until you have read the Instruction Manual.

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Model 5581/4
CONVERTER UNIT

SER # 246

PROPERTY OF ENGINEERING
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ITEM 9 COPY 3

BERKELEY division of
Beckman Instruments, Inc.

Lot 1, Serial 101 & above
15 February 1955

INTRODUCTION

The Model 5581/4 Converter Unit is a precision heterodyne unit designed for use in the Model 5580 Reference Generator. Installed in the Reference Generator, the Model 5581/4 will extend the Model 5570 or 5571 Frequency Meter to include the range of 42 to 155MC. Measurements within the extended range have the same accuracy as those made with the Frequency Meter alone.

A series of harmonic amplifiers in the Converter Unit multiply the 10MC signal received from the Model 5580 to produce additional reference frequencies of 40, 60, 80, 100 and 120MC. One of these frequencies is mixed with the signal being measured to produce a beat frequency within the range of 2 to 35MC. The Model 5580 amplifies the beat frequency to the level required to drive the Frequency Meter. The unknown frequency is found simply by adding the reading on the Frequency Meter to the reference frequency indicated by the RANGE SELECTOR on the Converter Unit.

SPECIFICATIONS

Range	42 - 155MC
Accuracy	Original accuracy of Frequency Meter (±1 cps, ± crystal accuracy)
Power	All power obtained from the Model 5580 Reference Generator
Reference Signal Input	Supplied by the Model 5580
Input Signal	0.1 to 0.25 volts rms into 50Ω impedance

OPERATION

To operate, install the Converter Unit in the receptacle of the Model 5580 Reference Generator. Connect the source of the signal to be measured to the INPUT jack on the Converter Unit. (The signal level should be between 0.1 and 0.25 volts into the 50 ohm input impedance.) Turn the Model 5580 POWER switch on and allow the instrument to warm up for a few minutes.

The band coverage for each RANGE SELECTOR position is as follows:

40MC	42 to 75MC
60MC	62 to 95MC
80MC	82 to 115MC
100MC	102 to 135MC
120MC	122 to 155MC

To find an unknown frequency, start with the RANGE SELECTOR at the lowest position (40MC). Turn the knob clockwise until the level meter of the Model 5580 shows a deflection. (The meter may show a deflection at higher ranges also, but they should not be used.) Adjust the GAIN control until the meter reads about 65 microamperes. This completes the adjustment of the Reference Generator and Converter Unit. Proceed to make a measurement with the Frequency Meter in the usual way. Add the frequency indicated by the RANGE SELECTOR to that which appears on the Frequency Meter, to obtain the frequency of signal being measured. For example, if the frequency meter reads 16.358060MC and the RANGE SELECTOR pointer is at 60MC, the unknown frequency is 16.358060 plus 60MC or 76.358060MC.

CIRCUIT DESCRIPTION

The Model 5581/4 has two basic functions:

1. It multiplies the 10MC reference signal which it receives from the Model 5580 to produce higher reference frequencies of 40, 60, 80, 100 or 120MC.

2. It mixes one of the new reference frequencies with the unknown frequency to produce a difference frequency within the band of 2 to 35MC.

V101, V102 and V103 are harmonic amplifiers which multiply the input reference frequency. The grid of V101 is tuned to 10MC. Its plate and the grid of the second stage (V102) are tuned to 20MC. Loose coupling between stages reduces unwanted sidebands.

The plate of the second stage and the grid and plate of the last stage are tuned to one of several frequencies according to the position of the RANGE SELECTOR switches (S101 and S102) which are geared together. The second stage (V102) always receives a 20MC signal. S101A, B & C connect the plate of this stage and the grid of the last stage to a circuit tuned to 40, 60 or 100MC, depending upon the position of the RANGE SELECTOR switches. The coupling between V102 and V103 is made by stray capacitance -- mainly that existing between the decks of S101. S102A & B connect the plate of V103 to a circuit tuned to the frequency indicated by the RANGE SELECTOR switch. When the range is set at 40, 60 or 100MC, V103 receives a signal of that frequency from the previous stage and amplifies it without further multiplication. When the range is set at 80 or 120MC, V103 functions as a frequency doubler.

The reference signal from V103 is coupled through C122 to grid 3 of the mixer, V104. The signal to be measured is introduced at J101 and appears at grid 1 of the mixer. A beat frequency equal to the unknown frequency minus the reference frequency is produced at the plate of V104. The output of V104 goes to the broad band amplifier of the Model 5580 through C127 and pin A1 of P101. The signals which produce the beat frequency also appear at the plate of V104, but all except those near 40MC are of too high a frequency to pass through the broad band amplifier. Signals near 40MC, particularly the strong 40MC reference frequency, are blocked by two traps placed at the output of the mixer. These traps (L116, C128 and L117, C129) are tuned for maximum attenuation at 40MC.

MAINTENANCE

Alignment of Multiplier Circuits

All coils have been adjusted at the factory and locked in position. They should not require adjustment due to tube changes or normal aging of components. However, should re-alignment be necessary, use the following procedure. This procedure will also help to localize a defective component.

If you suspect that the instrument has been badly de-tuned, tune the coils to near the proper harmonic with a "grid-dip" meter. After this rough adjustment (or when the unit is only slightly out of alignment) make the following fine adjustment. Tighten the lock nut on each coil after it is adjusted.

FIRST STAGE

1. Check and adjust the 10MC signal level from the Model 5580. (See instructions for Model 5580 Reference Generator.)

2. Insert the converter unit and connect a 0 to 200 microampere meter between test point E101 and ground -- negative to test point, positive to ground. (Test point numbers are printed on the chassis of the converter unit.)

3. Adjust L101 for maximum deflection on the meter. (Approximately 45μA).

4. Move the meter to E102 maintaining the same polarity and adjust L103 and L104 for maximum deflection on the meter. (Approximately 65μA).

NOTE: If either coil is badly off tune there may be no indication on the meter. In this case, use an r-f probe such as the RCA WG 264 Crystal Diode Probe in conjunction with a vacuum tube voltmeter. Hold the probe near the plate lead of V101 and adjust L103 for maximum indication on the VTVM. Then adjust L104 as described above.

SECOND AND THIRD STAGES

1. Replace the selector switch shield if it has been removed.

2. Move the microammeter to E103 maintaining the same polarity.

3. Turn the Model 5580 GAIN control to the extreme clockwise position.

4. Connect a vhf signal generator to the Converter Unit INPUT jack and terminate the OUTPUT jack of the Model 5580 with a 100Ω resistor.

5. (a) Set the RANGE SELECTOR at 80MC.
   (b) Adjust the signal generator output to 85 MC at 0.1 volts.
   (c) Adjust L105 and L108 for maximum deflection on the meter connected to E103. (Approx. 5μA).
   (d) Adjust L113 for a maximum indication on the output meter of the Model 5580.

6. (a) Move the RANGE SELECTOR to the 120MC position.
   (b) Adjust the signal generator output to 125MC at 0.1 volts.
   (c) Adjust L106 and L109 for maximum deflection on the meter connected to E103. The meter should read about 5μA.
   (d) Adjust L115 for a maximum indication on the output meter of the Model 5580.

7. (a) Move the RANGE SELECTOR to the 100MC position.
   (b) Adjust the signal generator output to 105MC at 0.1 volts.
   (c) Adjust L107, L110 and L114 for a maximum indication on the Model 5580 output meter. (The meter connected to E103 will not be deflected in this position.)

8. (a) Move the RANGE SELECTOR to the 60MC position.
   (b) Adjust the signal generator output to 65MC at 0.1 volts.

GROUND COMMUNICATIONS SECTION

(c) Adjust L112 for a maximum indication on the Model 5580 meter.

9. (a) Move the RANGE SELECTOR to the 40MC position.
(b) Disconnect the signal generator. If an indication appears on the Model 5580 meter, the 40MC traps (L116, C128 and L117, C129) are out of adjustment. Adjust the traps as described below before continuing the alignment of the 40MC band.
(c) When the traps are adjusted, connect the signal generator and adjust its output to 45MC at 0.1 volts.
(d) Adjust L111 for a maximum indication on the Model 5580 output meter.

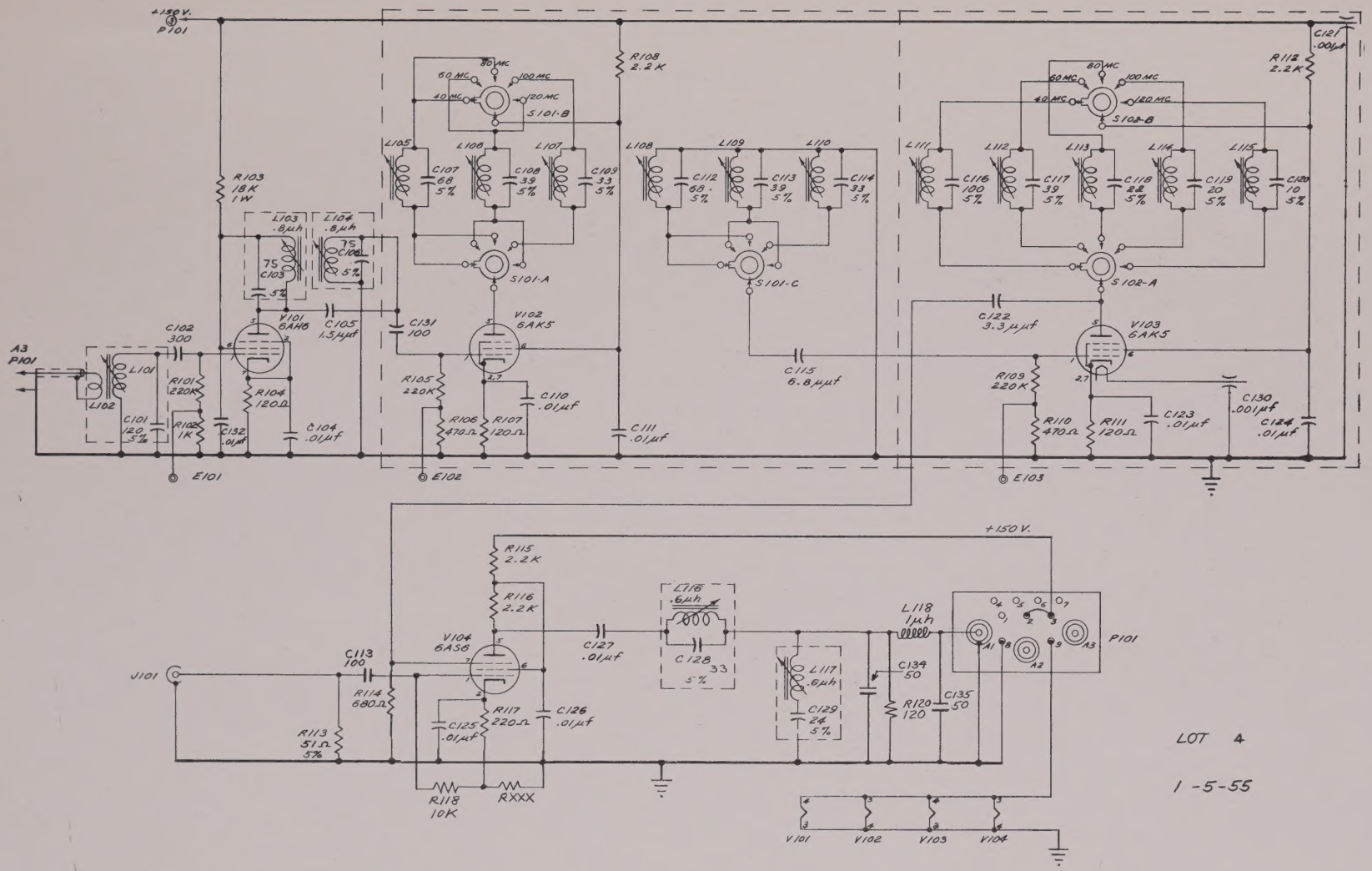
FINAL TEST

The high pass filter between the broad band amplifier and the level meter of the Model 5580 prevents the meter from being deflected by beat frequencies near zero. When the external frequency at the Model 5581/4 input is near the reference frequency indicated by the RANGE SELECTOR, the meter should show no deflection. A deflection under these conditions indicates that the reference frequency is some other harmonic than that indicated by the RANGE SELECTOR switch or that the instrument is otherwise incorrectly aligned.

Check each position of the RANGE SELECTOR by "rocking" the signal generator back and forth across zero beat (plus and minus about 4MC). If the meter drops sharply to zero as the signal generator approaches zero beat, the circuits involved are correctly aligned. If the meter fails to drop to zero or fails to rise on either side of zero beat, re-align the circuits involved.

Adjustment of 40MC Traps

If an indication appears on the Model 5580 meter when the RANGE SELECTOR is at 40MC and no external signal is reaching the input of the Converter Unit, the 40MC traps (L116, C128 and L117, C129) are de-tuned. To readjust, turn the RANGE SELECTOR to 40MC and adjust one of the coils for minimum deflection on the meter. Note the position of the slug, then move it one-half turn in either direction. Adjust the other coil for minimum deflection and return the slug of the first coil to the position noted.



LOT 4

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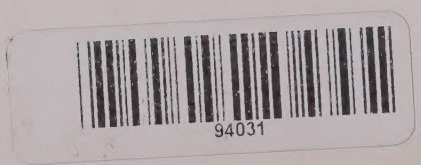
ALL RESISTORS ½ W., 10%, CARBON UNLESS OTHERWISE NOTED.
ALL CAPACITORS WITH VALUES GREATER THAN ONE ARE IN μμf, 20%, 500 V., UNLESS OTHERWISE NOTED.
ALL CAPACITORS IN μf. ARE -20%, +80%, UNLESS OTHERWISE NOTED.

MODEL	TITLE
5581/4	SCHEMATIC

GROUND COMMUNICATIONS SECTION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